

Review and Discussion of Past and Future Climates, of their Astronomical, Solar, and Anthropogenic Forcing. Strategies for Future Space and Modeling Research
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In the last 4.5 billion years, solar radiation has represented an unparalleled forcing factor for providing energy to the Earth. Paleoclimate modeling based on observational evidence has helped identify other strong factors such as the greenhouse effect, mostly by atmospheric CO₂, the obliquity of the Earth and plate tectonics. For most of the past 100,000 years (the time it took for human beings to reach the modern age and colonize the planet), the Earth temperature was 8°C colder than today. We will analyze whether the next centuries will offer humanity a cold or a warm climate.

In that attempt, we will review briefly the variability of the factors affecting the climate and discuss the uncertainties that limit the accuracy of modeling their short-term and long-term effects. We will also identify from most recent data the anomalies observed in climate variation and discuss their possible causes, be they astronomical, solar, or anthropogenic.

Future strategies for improving our understanding of the complex interactions between these different causes will be proposed based on a set of coherent space missions including both solar physics and Earth observation space systems as well as improvements in climate forecasting.